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FUNCTIONAL INTERPRETATIONS OF PREPOSITIONS: INFERENCE OR IDIOSYNCRASY

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1. Introduction

Recent years have shown growing interest in prepositional semantics. Spatial relations expressed by prepositions are associated with concrete visual scenes, yet there is particularly intriguing cross-linguistic variability in mapping the spatial relations in the world. As a result spatial prepositions are considered notorious for being hard to acquire when learning a second language.

Functional interpretations of spatial prepositions are seen as based on the interactional properties of the related objects and their object-specific characteristics. Perceptual object-independent characteristics (distance between the objects, their direction of moving, etc.) are also found to be presupposed by their interactional properties. Regarding these findings, it is suggested that apart from a basic geometrical specification, the semantic representation should contain functional information.

A number of researchers have developed computational models, which aim to generate spatial references[1]. These models focus on spatial configurations as geometric constructs such as shapes, location, distance, overlapping between objects, etc. However, the great number of real-world scenes a spatial expression can refer to presents a serious problem for this approach. There seems to be a virtually illimitable number of object- and even situation-specific restrictions on the usage of a particular expression[2].

2. What underlies the meanings of spatial prepositions?

Prepositions represent spatial relations between two objects/entities, one of them is in focus and the other one is in the background. Following Langacker (1987), we use the term *Trajector* (TR) for the focus element and the term *Landmark* (LM) for the reference element[3]. It is hypothesized that a preposition not only specifies a spatial relationship between two entities, but also requires knowledge about such things as the canonical function of an entity or the typical interactions which it has with other entities. Often, this restricts the range of possible meanings of the prepositional phrase (PP) and hence the contexts in which it may appear. For instance, the meaning of the preposition *in* is often represented in terms of the mathematical notion of "inclusion". A scene where a crate is

[1] E.g. Gapp 1994; Logan and Sadler 1996; Regier 1996.

[2] Herskovits 1986.

[3] We use these terms even in abstract domains where the TR is not an object in any strict sense (e.g. I was on time).

overturned and there is an apple within its physical boundaries, the apple cannot be described as being *in* ((1)**the apple is in the crate*).

Fig. 1

Fig. 2

Such spatial relation should be described as (2) *the apple is under the crate* (Fig. 1). Therefore, it should be added to the lexical entry of *in* that the preposition is not used when the LM is a concave object positioned with its concavity opening downwards. On the other hand, a similar scene where a bulb is within the boundaries of a socket is said to be *in the socket* (Fig. 2), and not under it, although the socket's concavity opens downwards, This, in its turn, may be explained by the intrinsic orientation of the objects and their restrictions imposed on the specific orientation of specific objects.

A number of studies on prepositional semantics[4] account for these restrictions with the fact that spatial meanings reflect not only perceptual experience of the scenes considered, but also their functional interactions. For example, Miller and Johnson-Laird (1976) suggest that the notions of "contiguity" or "juxtaposition" do not always require the usage of the English preposition *at*. There are situations, where these types of relations hold, but the preposition cannot be used: (3)**The deck-chair is at the ship.* (4)**Sam is at Bulgaria.* In order to define the meaning of *at*, they introduce the notion "region": a portion of space "where x can interact with y socially, physically, or in whatever way x.s conventionally interact with y.s"[5]. The notion of "interaction" explains the inappropriateness of *at* in the two sentences: a deck-chair and a ship, as well as a person and a city normally do not interact with each other.

Function is seen as a factor added to geometry when interpreting prepositional meaning: the uses where the TR's geometry is not enough to indicate its position, the notion of LM's "function" helps to define it. In his analysis of the Dutch preposition *in* Cuyckens' (1993) similarly suggests that in most cases its meaning and spatial relation can be explained in terms of geometry as "three-dimensional", "bounded", etc; and in cases, where the geometric characteristics cannot account for the usage, the notion "function" is involved (namely the scene with the overturned crate and the apple). This solution, however, is unsatisfactory as it presupposes that some uses are determined by geometry and others by function.

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[4] Miller and Johnson-Laird 1976; Herskovits 1986; Cuyckens 1993; Coventry 1998.

[5] Miller and Johnson-Laird (1976) use x to refer to the left argument of the preposition and y for the right argument of the preposition. In the present paper these entities are marked by the terms TR and LM, respectively.

The aim of the present study is to prove the hypothesis that a functional property of a preposition is found in its different perceptual properties. Proving the hypothesis will explain why numerous perceptually different uses of a preposition fall under one linguistic category. Prepositional meaning then can be delineated in terms of function thus avoiding the many restrictions associated with a geometry-based semantic representation.

This paper focuses primarily on the English preposition *on* and its functional interpretations. It demonstrates that function plays a significant role in prepositional semantics.

3. Functional Properties

Prepositions possess functional semantic properties, and their meaning is characterized by information about certain interaction, currently taking place or anticipated, between the spatially co-related objects.

(5) *Max is on the train.* (Fig. 3)

(6) *Max is {in/*on} the old train in the museum.* (Fig. 4)

(7) *Mercedes is on display this week.*

(5) means that Max is in a position to use the train in its canonical function as a means of transport. As the train in (6) does not perform this function, *on* must be replaced by *in*. In (7), the preposition with a bare noun complement forces the inference that Mercedes cars participate in an exhibition. If we provide *display* with an article, this implication does not necessarily hold, and the bracketed phrase becomes acceptable.

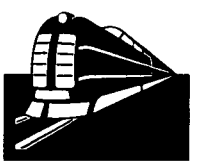

Fig. 3 (5) *Max is on the train (travelling).*

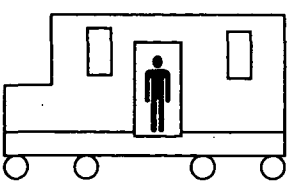

Fig. 4 (6) *Max is in the old train in the museum.*

In addition to PPs, there are other constructions interpreted in a similar way. One such construction is the 'verb-particle combination' or 'phrasal verb', where information about the functional relationships between objects should be

deduced as there often is an implicit LM of a prepositional relation expressed by the particle. For instance, in the VP *put a disk on*, the implicit LM of *on* must be the type of object on which the disk can fulfil its function and on which disks are canonically put, namely a disk player.

Various linguists suggest that functional interpretations 'come from the context'. Indeed, with *some* expressions they result from context-based inference, but there is ample evidence that this is not always the case. We cannot claim that the functional reading of the LM in (8) *I put a disk on* is context-bound, since *put on* only allows contexts where this interpretation is possible, i.e. one where the LM is put in a position where it can be used in its typical function (e.g. *put jeans on, put glasses on, put the kettle on*).

'Functional' is used here neither as an opposite to 'lexical' nor in the extended sense of 'functional concepts' like support or the exertion of force[6]. Rather, 'functional' is used here in the non-technical sense 'pertaining to the function/purpose of an object'. Thus, *put on a disk* is a functional construal because it is only usable when the disk is put in a place where it can be heard. Similarly, (5) suggests that Max's presence on the train is connected to its function for transportation. We assume that functional readings should be seen as part of a bigger phenomenon which manifests itself in various interpretations beside functional ones. For instance, (9) *the glass is on the table* (Fig. 5) is usable of any situation where the glass is in contact with the table, its context-free interpretation involves a coercion or metonymy in which it is the stem of the glass which is on the tabletop.

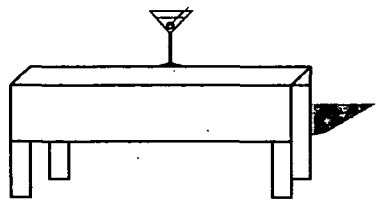

Fig. 5 (9) *The glass is on the table.*

This special interpretation is not functional in our sense, since neither object needs the other to function. Rather, the PP has what we roughly call a *stereotypical* interpretation: it refers to the memorised, standard configuration which automatically comes to mind if one imagines a vertical alignment between glasses and tables. In other words, functional interpretations are inferences that can be made about the logically possible denotation of an expression *irrespective of the context in which it is embedded.*

[6] E.g. Vandeloise 1986, Garrod & Sanford 1988.

4. PPs

Functional PPs in English often assume the form of the following constructions:
(10) *on board, on air, on line, on guitar, on CD*
These consist of a preposition and a noun without a determiner. These constructions will be called 'small PPs' (cf. 'small construction' in Sadler & Arnold 1994, who apply the term to English prenominal adjectives, which, they argue, have both syntactic and lexical properties). The term is chosen for its shortness and is not theoretically grounded. Small PPs often have a functional reading where a normal PP does not:
(11) a. *he played a good solo on piano* vs. *there is a vase on *(the) piano*
b. *the concert hall staff are on *(the) stage cleaning up after the concert*
It is not clear what makes possible the lack of determiner in small PPs. We cannot say it is the noun as there are many cases where the bare N only occurs inside a small PP with a specific preposition: (12) *Artists 'draw on air' to create 3D illustrations* vs. *The plane has been in the air for 12 hours.*

Regularities in small PPs should be found, since there is a great number of them in English, and since some groups of small PPs are formed by what seem to be productive, transparent processes. They occur as first elements in compounds (*in-house solutions, online banking, out-of-body experience*) and in forming exocentric compounds (*afterbirth, underground*)

Although many small PPs force a functional reading which is not present with the full PP, and although the preposition's lexical entry seems to be responsible for determining which nouns are eligible for the construction, most small PPs share the semantics of the preposition in its normal uses. We hardly want to assume that *on* in (13) has two different lexical entries.
(13) a. *the served the bottle on ice* (functional reading of *ice*; used for cooling)
b. *he left the ice tongs on the ice* (functional reading of *ice* is optional; he could have forgotten them there because ice tongs don't need cooling)

4.1. Types of PPs which allow a functional interpretation

Only brief accounts of functional uses of prepositions were found[7]. It seemed worthy to analyse in detail a large sample of data.

4.1.1. **Institutional LM:** A subtype of functional readings of PPs is the institutional reading, where the LM is a building. The TR is in the LM in order to participate in activities for which the LM was designed. As buildings are three-dimensional containers, they are not used with *on*, which requires a two-dimensional surface as an LM. Below there are a few examples with other prepositions which allow functional reading.
(14) *in/at/to college; at/in high school; in/to court; in/at/to church; to/in hospital; in/to prison.*

[7] E.g. Becker 1994: 55, Becker et al 1988: 19; Cuyckens 1994: 190; Herskovits 1986: 154, Herweg 1989: 112; Jackendoff & Landau 1992: 116.

It should be noted that *Mary is at school* has two interpretations, a **momentary** one in which she is on the school premises at the moment of speaking, and a **habitual** one, which merely states that she is still enrolled in the school. If we try to derive the habitual one from a theory of generic statements, we find out that there are various idiosyncratic contrasts like *in school, in church* (momentary) vs. *in college, in the church* (momentary or habitual).

Institutional uses of *at* rarely appear in uses other than small PPs. Garrod & Sanford[8] consider the functional meaning of *at* as its basic meaning and claim that being *at the supermarket* implies that one is there to shop. If we compare the two context-free sentences like *he's at the supermarket* and *he's in the supermarket*, we find that the first implies the functional reading more strongly than the second, but more context can easily change this reading, for instance *the workers are at the supermarket repairing the ceiling*. Such cases, as well as other purely spatial uses of *at*, e.g. *the plane refuelled at Berlin, I'll meet you at the cinema*, prove it incorrect to assume a functional interpretation of *at* as a primary or central one.

4.1.2. **Physical objects as LM, human beings or events as TR:** With musical instruments, we find small PPs with *on*, but they are restricted to basic-level instruments (*on piano/violin*) and at least one is idiomatic (*on vocals*).

(15) a. *Grand did a solo on the saxophone/synthesiser/bass guitar.*
b. *Merlyn wrote the story on the computer/typewriter/PC.*
c. *Gordon was on the telephone while his wife was cooking.*

It seems that the uses in (a) and (b) have an event as TR which is perhaps conceptualised as being 'supported' by the LM-instrument.

Finally, a number of small PPs show canonical interactions between people and entities:

(16) *they are on stage (performing/ *cleaning it); people were on board (travelling/ *repairing it)*

4.1.3. **Animate/personified LM:** Small PPs with the English preposition *on* are restricted to examples where LM is a human being who carries the TR in his/her hand, pocket, handbag:

(17) a. *"Got any matches **on** you? Or a lighter?"*
b. *He had not yet acquired the habit of going about with any considerable sum of money **on** him.*

They always force the interpretation that the TR is located within the LM, which entails that the LM owns the TR.

4.1.4. **Objects interacting with other objects:** English small PPs seem to be rarer in this class. That the PP in *the bottle of wine on ice* qualifies as functional and 'small' (although *ice* is a mass noun and thus capable of staying without an

[8] Garrod & Sanford 1988, 158.

article in other contexts) is seen in the unacceptability of **the empty bottle is on ice* or **the ice tongs are on ice.* (18), however, shows a related, productive use of small PPs with *on* where the TR is an abstract object like music or information. Entities which do not properly belong to the information carrier appearing as LM (18d) are unacceptable with the small PPs.

(18) a. *she has Pavarotti's Concerto* ***on*** *CD/ record/ tape*
b. *he's got the movie* ***on*** *video/DVD*
c. *she has a copy of the program* ***on*** *disc/ CD-ROM*
d. *there is a virus/ scratch* ***on*** **(the) disc*
e. *they saw it* ***on*** *TV/ heard it* ***on*** *radio*

4.1.5. **Large vehicles as LM:** English uses *on* with larger vehicles (e.g. *on the bus, ship, ferry, boat, aircraft, spaceship; *on the car/ rowboat*). As mentioned above, this *on* cannot be used with decorative vehicles (**we got on the old train on display in the museum*). Jackendoff & Landau[9] suggest that the use of *on* may be due to the conceptualisation of large vehicles as platforms. This is not convincing since large vehicles similarly to small ones visually resemble containers and not platforms. Presumably, we must treat this as an at least partially idiosyncratic diachronic relic. The fact that those vehicles which allow *on* also allow *on board* invites the speculation that the construction arose diachronically via loss of *board* in contexts like *on board of the ship* etc.

4.2. Phrasal verb interpretation

At least two strategies can be used for the inference of the implicit LM of a phrasal verb. One is to assume that the implicit entity is part of a functional situation, exploiting knowledge about functions of objects or their stereotypical locations (Wunderlich 1983). For instance:

(19) *He went to the table and put the kettle/record/ his hat* ***on*** (on the stove/turntable/head, not on the table)

In other cases, the LM is associated with some entity in the context, as in (20).

(20) a. *He went to the suitcase and put the cassette* ***in*** (in the suitcase, not in a tape recorder)

b. *She opened a drawer and took* ***out*** *the video* (out of the drawer, not out of a video player)

This strategy, however, cannot be used for *on* as it always expresses the objects' stereotypical function.

5. Generalisations on functional interpretations

The data so far proves the following generalisations, suggested by McInytre (2001b), about the occurrence of functional interpretations:

[9] Jackendoff & Landau 1992, 117.

(21) CANCELLED FUNCTIONAL INTERPRETATION: Expression E should not have a functional interpretation if there is another expression E' which has an equivalent functional interpretation and (a) expression E is logically more specific than E', and/or (b) E is formally less compact than E'.
(22) SPECIFIED FUNCTIONAL INTERPRETATION: A functional reading for an expression E can be the result of a specification in its lexical entry or the entry of some expression within E. If so, the expression cannot be used in a context incompatible with a functional reading. Such functional readings are termed '**strong** functional readings'.
(23) DEFAULT FUNCTIONAL INTERPRETATION: An expression E forces a functional interpretation unless:
a. the full context of E makes a functional reading implausible, or
b. the generalisation in (21) rules out a functional interpretation.

These generalisations lead us to the assumption that functional interpretations can be immediate contextual inferences[10], but it changes because of the additional statements about when they do not occur, when they are obligatory and the observation that some functional interpretations arise from lexical specification rather than contextual inference. A **weak** functional reading disappears as soon as more context makes it implausible. Good examples here are all cases with functional reading of *at* when it is not in small PPs. Thus, *the old woman is at the shopping centre* implies that she is shopping, but only if the context does not suggest otherwise *she's homeless and it's so cold outside, so she's at the shopping centre all the time.* Many English particle verbs supply similar examples. Thus, *I put the CD in* implies a CD player as LM in the default case, but the context can overrule (*when you pack your bag, don't forget to put the CD in-we could listen to it in the car*). Therefore:

Weak functional readings -are inferred, not lexically specified
-can be overridden by the context
Strong functional readings -are lexically specified, not inferred
-cannot be overridden by the context.

The generalisation in (21) is conceptually plausible because, essentially, it is based on Grice's Maxim of Quantity (1975) ('Do not make your contribution more informative than is required'). If a speaker chooses an expression E instead of a less semantically specific and/or more concise expression E' which expresses a functional reading R, then the hearers assume that R is not part of the speaker's message, for if it were, there would be no need for a more specific expression (McInytre 2001b). Additionally, (21) is compatible with the general tendency in the vocabulary of languages that one of two absolute synonyms tend to disappear[11].

(21) can be supported empirically by PPs like those in (24), where the choice of *on top of* instead of *on* rules out the functional interpretation:

[10] As e.g. Cuyckens 1984 and Herweg 1989 suggest for functional readings of prepositions.
[11] Cruse 1986: 270.

(24) *the steak on top of the plate/ the pot on top of the stove* (plate/pot are probably upside-down), *the record on top of the record player* (record not properly on the turntable)

However, there is nothing in the spatial semantics of *on top of* which renders functional uses unlikely. In (24) the respective conditions of upper surface contact are fulfilled by the functional readings. Rather, the functional readings seem to be ruled out because of the choice of the more specific and less compact prepositions in a context where *on* would have been sufficient to express the functional readings. It is apparently interpreted as a sign that the speaker is wishing to convey something different from a functional reading, in accordance with (21).

The generalizations introduced in this section are general principles governing when functional readings are obligatory, optional or impossible. The principles do not cover all the data. The following examples seem to be important problem cases.

6. Small PPs and productive functional uses of prepositions

A generalisation about a bare N is not sufficient to explain the semantic behaviour of small PPs. A spatial meaning of a preposition which is found in most functional small PPs, may also be found in full PPs. Thus, *a concert on CD* and *a concert on a CD* display the same TR-LM relationship, except that the full PP is not confined to a particular sense of the preposition (cf. *the dirt and scratches on the CD*).

Candidates for productive constructions are

on with information carriers (*on laser disc, on DVD*)

on where the LM is a musical instrument and the TR is either a music performance or the musician (*Dave is on piano, she did a solo on harmonica*; these were mentioned in relation to (11))

These new formations are productive but only with a special class of noun complement (e.g. information carriers and basic-level instruments). The same phenomenon we also find in some full PPs where *on* is used with large vehicles (*on the bus, on the airplane, on the Orient Express, on the Titanic*). What is idiosyncratic is that the prepositional use specifies that it must combine with a particular class. Analogous restrictions have been suggested in the studies of Pinker (1989) and McInytre (2001).

Another important characteristic referring to these restrictions is that they are followed by specific functional entailments. For instance, the use of *on* in *on the train/bus/ferry* is associated with functioning vehicles. The selective restriction determining the choice of LM could be either 'large functioning vehicles', or the LM should have a functioning means of transport as an obligatory entailment. In this case *the type of LM* is specified, but there does not seem to be any specification regarding the *relationship between the TR and LM*: a context-free use of *he was on the bus* suggests the use of the bus as a means of

transport. This, however, is cancellable by additional context, e.g. *the cleaner was on the bus removing the graffiti.*

7. Conclusions, additional observations and consequences

Functional readings are not completely haphazard, when one accepts lexical idiosyncrasy as an inseparable part of the analysis, but several generalisations are possible. the functionally-specialised uses of *on*, discussed in 5, are a consequence of a more general range of uses of the preposition compared to *on the top of*. Particle verbs hardly ever show obligatory functional readings in English. One of the few exceptions is *put on*. The existence of expressions which lexically specify functional interpretations can be treated as a means for or against a functional interpretation, thus achieving clarity without making the listener to guess the right interpretation from an unhelpful context. Thus, if a text begins with *Amy was on board*, the small PP makes it immediately clear that she was travelling by ship. The lexical stipulation that *on board* is related to a large vehicle enables us to express the functional connection between Amy and the ship in two words, and, together with (21), to cancel the functional reading if *on the board* or *on the top of the board* are chosen instead of the small PP.

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